An apparatus for detecting animals

5   THE BACKGROUND OF THE INVENTION AND PRIOR ART

The present invention refers to an apparatus for detecting
an animal having a body part and a head part, comprising: an
animal passage extending in a transport direction, said
10   passage being defined by a first enclosure member and a
second enclosure member, which members are arranged on a
respective side of the passage and extend substantially in
parallel to said transport direction, and a sensor device,
which is arranged to sense the animal in the passage.
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The present invention refers to the managing of animals in
general. The invention is thus applicable to animals such as
cows, sheep, goats, horses, buffaloes etc. In the following,
it will be referred to the managing of cows although the
20   application is not limited to any specific kind of animals.
All these animals to which the present invention is
applicable have a head part formed by the neck and the head
of the animal, and a body part extending rearwardly from the
neck and formed by the body and including the rear legs and
25   the forward legs of the animal.

When managing cows it is often important to be able to
detect the position of an individual cow with a high
precision. When a number of cows are moving forwardly in a
30   passage, a so-called lane, it is necessary to be able to
interrupt the movement of the cows by means of an
interruption gate, a so-called saloon gate, or to redirect
one or several cows from the passage by means of a direction
gate. If these gates are not working in a manner
35   synchronised with the position of the cows, the function is
not reliable and the efficiency of the managing of the cows

is negatively influenced. The cows are sometimes walking so close to each other in a train of cows in such a passage that there is no completely free space between the cows. In such a situation, it is difficult to detect the individual 5 cows by means of conventional detector and sensing means including, for instance, a photo cell.

It is also known to provide the cows with a transponder for the identification of the cows. By means of such a 10 transponder, it is possible to detect the position of the cow for the control of the interruption gate to be closed behind the cow. However, the precision in such a detection by means of a transponder is not sufficient, making it difficult to close the interruption gate between two 15 successive cows, and also creating a risk of hurting or injuring the cows. Moreover, a fact that is not taken into account in the prior art solutions is that the cows may have various lengths, which also means that the interruption gate will not always close in an optimum manner behind the cow. 20

Various apparatuses including means for detecting and sensing animals are described in the patent literature.

US-A-5,653,192 discloses an apparatus for sorting animals. 25 The apparatus comprises a passage defined by longitudinal rails. An identifying sensor is provided for identifying the animals walking along the passage by sensing a transponder carried by the animals. The identifying sensor includes two antennas arranged on a respective side of the passage. 30

US-A-4,288,856 discloses a system for managing a live-stock having means for separating poorly performing animals. The system includes a passage with gates and photo detectors. The photo detector may include a photo cell on one side of 35 the passage and a light source on the other side of the

passage, wherein the light beam is broken by the animal passing the detector.

US-A-4,274,083 discloses an apparatus for identifying moving objects, for instance an animal carrying a transponder. The cow carrying the transponder may be identified when passing a loop antenna.

SUMMARY OF THE INVENTION

The object of the present invention is to provide an apparatus for detecting an animal, and more specifically for detecting an animal with a high precision at a determined position.

This object is achieved by the apparatus initially defined, which is characterised in that the sensor device is arranged to sense a parameter related to a cross-section size of the animal at a determined position in the passage, and to produce a signal when the parameter fulfils a certain condition. By such an apparatus it is possible to detect in a reliable manner the exact position of the front end of the animal, or more precisely the beginning of the body part, and the rear end of the animal, or more precisely the rear end of the body part. A cross-section size, such as the width of the animal, normally varies along the length of the animal in such a way that the largest cross-section size of the head part of the animal is smaller than the smallest cross-section size of the body part of the animal. By using a sensor device detecting such a cross-section size, it is thus possible to identify the beginning and the end of the body part of the animal. Even if the animals are walking very close to each other so that the head of an animal is lying on the body part of the forward animal, it is possible to detect the short gap or short distance between the end of the body part of the forward animal and the beginning of the

body part of the following animal, since there is always a reduction in the cross-section size between the animals.

According to an embodiment of the present invention, the sensor device is arranged to produce said signal when the value of said parameter indicates that the cross-section size of the animal is less than a predetermined value at the determined position. Consequently, the sensor device may be arranged to detect when the cross-section size of the animal is less than the cross-section size of the body part of the animal. More precisely, the parameter may be related to the width of the animal seen in a determined direction, wherein the sensor device is arranged to produce said signal when said parameter indicates that the width of the animal is less than a predetermined value at the determined position. Preferably, the determined direction is a substantially vertical direction. The difference in the horizontal width between the body part and the head part of the animal is substantially constant, and particularly easy to identify in a vertical direction. Moreover, the determined direction may advantageously be a substantially vertically downward direction. It is advantageous to arrange the sensor device above the animals in such a way that they are directed downwards since the environment is better and less subjected to dirt above the animals.

According to a further embodiment of the present invention, the determined direction is a substantially horizontal direction. The sensor device may thus be directed vertically downwards, horizontally or in any direction therebetween.

According to a further embodiment of the present invention, the sensor device comprises at least a first sensor and a second sensor, wherein the first sensor is arranged to sense the presence of the animal at a first point of the passage and wherein the second sensor is arranged to sense the

presence of the animal at a second point of the passage. Advantageously, the first point and the second point are both located at the determined position with regard to the transport direction, but spaced apart from each other with a distance, wherein said distance is larger than the width of the head part but smaller than the width of the body part of an animal of a normal size to be guided through the animal passage.

According to a further embodiment of the present invention, the first point is located in the proximity of the first enclosure member whereas the second point is located in the proximity of the second enclosure member. The first and second points are thus located inside the respective enclosure member within the passage. Furthermore, the first sensor and the second sensor are both provided above the passage to sense the animal passing below the respective first and second sensors.

According to a further embodiment of the present invention, the apparatus comprises a control member connected to the sensor device. Preferably, the control member may be arranged to count the animals passing the animal passage in response to the sensing of the sensor device. The apparatus according to the invention may thus be used for counting the animals passing through the passage.

According to a further embodiment of the present invention, the apparatus comprises a gate device arranged in the passage to take- one of an open position and a closed position. The control member may then be arranged to control the position of the gate device in response to the sensing of the sensor device. The gate device may include a gate, which is provided in the proximity of the sensor device and arranged to close the passage, and thus to stop the following animals from moving further forward in the passage

and to permit such further forward movement in the transport
direction when so desired. Moreover, the gate device may
include a gate, which is provided in the proximity of the
sensor device and arranged to close the passage and open an
5   exit passage leading away from the passage, and thus to
direct a specific animal in a desired direction away from
the passage or along the passage.

BRIEF DESCRIPTION OF THE DRAWINGS

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The present invention will now be described more closely
by means of various embodiments thereof and with reference
to the drawings attached hereto.

15   Fig 1   shows schematically a view from above of an
                 apparatus according to a first embodiment of the
                 present invention.
      Fig 2   shows schematically a view from above of an
                 apparatus according to a second embodiment of
20   the present invention.
      Fig 3   shows schematically a view from above of an
                 apparatus according to a third embodiment of the
                 present invention.

25   DETAILED DESCRIPTION OF VARIOUS EMBODIMENTS OF THE
      INVENTION

      Figs. 1, 2 and 3 disclose a respective embodiment of an
      apparatus for detecting an animal. The animal is in the
30   embodiments disclosed a cow 1. The cow 1 has a body part 2
      and a head part 3. The head part 3 includes the head and
      the neck of the cow 1. The body part 2 extends rearwardly
      from the neck and includes the body with the forward legs
      and the rearward legs of the cow 1.

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The apparatus comprises an animal passage 4 extending in a transport direction t. The animal passage 4 is in the embodiments disclosed an elongated space defined by a first enclosure member 5 and a second enclosure member 6.

5 The enclosure members 5 and 6 may comprise usual metallic rail constructions dimensioned to withstand forces from the cows 1 and prevent them from deviating from the animal passage 4. The first enclosure member 5 and the second enclosure member 6 both extend in the longitudinal

10 transport direction t on a respective side of the animal passage 4.

The apparatus also comprises a sensor device 7, 8, which is arranged to sense the cows 1 moving forwardly in the

15 transport direction t in the animal passage 4. More specifically, the sensor device 7, 8 is arranged to sense the cows 1 at a determined position in the passage 4. The determined position is indicated by the transverse line p extending substantially perpendicular to the transport

20 direction t. Consequently, the determined position means that the cow 1 has reached a certain position with regard to the longitudinal direction t, whereas the transverse position of the cows 1 in the animal passage 4 is substantially defined by the enclosure members 5 and 6.

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The sensor device 7, 8 is arranged to sense a parameter related to a cross-section size of the cow 1 at the determined position p. In the embodiments disclosed, the parameter is related to the horizontal width of the cows

30 1, i.e. the width seen in a vertical direction. The horizontal width of the cows 1 is one of several possible cross-section sizes of the cow 1. However, also other widths than the horizontal width may be sensed according to this invention, for instance a vertical width or any

35 width sensed between the horizontal width and the vertical width. Cows and other animals to which the invention is

applicable normally have a cross-section size and a
horizontal width that varies along the length of the cow
1. More specifically, the body part 2 has a significantly
greater horizontal width than the head part 3. When the
5   cows 1 are crowded in the passage 4 and thus are present
very close to each other in a train of cows 1, as appears
from Figs. 1 and 2, in such a way that the head part 3 of
a first cow 1 lies partly above the body part 2 of a
second forward cow 1 there will be a gap or a distance
10   between the body part 2 of the first cow 1 and the body
part 2 of the second cow 1. Since the head part 3 of the
first cow 1 has a smaller width than the body part 2 of
the second forward cow 1, the cross-section size of the
train of cows 1 will be smaller at this gap between the
15   first cow 1 and the second cow 2. The sensor device 7, 8
is thus arranged to sense the cross-section size and to
produce a signal when the parameter fulfils a certain
condition, i. e. when the cross-section size of the cow 1
is less than a predetermined value at the determined
20   position p. In the embodiments disclosed, the sensor
device 7, 8 is arranged to produce a signal when the
horizontal width of the cow 1 is less than a predetermined
value at the determined position p. The sensor device 7, 8
is thus arranged to sense the cows 1 in a determined
25   direction which is a substantially vertically, downward
direction.

In the embodiments disclosed, the cross-section concerned
thus extends in a plane substantially perpendicular to the
30   transport direction. It is to be noted, however, that the
invention also is applicable with a cross-section
extending in a plane having a normal direction forming an
angle of inclination with the transport direction t.

35   In the embodiments disclosed, the sensor device 7, 8
comprises a first sensor 7 and a second sensor 8. The

first sensor 7 is arranged to sense the presence of a cow
1 at a first point of the passage 4 whereas the second
sensor 8 is arranged to sense the presence of said cow 1
at a second point of the passage 4. The first point and
5 the second point are both located at the determined
position p with regard to the transport direction t. The
first point and the second point are thus located along
the transverse line p but spaced apart from each other
with a distance d. The distance d between the first point
10 and the second point is selected in such a way that the
distance d is larger than the horizontal width of the head
part 3 of a cow 1 of a normal size, but smaller than the
horizontal width of the body part 2 of a cow 1 of a normal
size. In the embodiments disclosed, the first sensor 7 and
15 the second sensor 8 are both located vertically above the
first point and the second point, respectively, in the
passage 4. As appears from Figs. 1 and 2, the first sensor
7 and the first point is located in the proximity of the
first enclosure member 5 seen in a vertical direction. The
20 second sensor 8 and the second point is located in the
proximity of the second enclosure member 6 seen in a
vertical direction. The first sensor 7 and the second
sensor 8 are thus provided above the animal passage 4 and
the cows 1 in order to be able to sense cows 1 passing
25 below the respective sensors 7 and 8.

The sensors 7, 8 may be of any suitable kind, for instance
optical sensors, such as photo cells or video cameras, or
any other proximity sensors, such as IR-sensors. It is to
30 be noted that the invention is not limited to any kind of
sensor but that any suitable sensor which is and will be
available may be used. For instance, each of the sensors 7
and 8 may include a light-emitting member producing a
light beam, such as a laser member, and a photo cell
35 sensing the emitted light. The presence of the animal is
the detected when the light beam is broken by the animal.

The apparatus also comprises a control member 10
schematically disclosed in Figs. 1 and 2. The control
member 10 is connected to the sensor device, i. e. to the
first sensor 7 and the second sensor 8, and arranged to
receive the signals produced by the sensors 7 and 8. The
apparatus may also include an identification device 11
arranged in the proximity of the animal passage 4 for
identifying the individual cows 1 passing through the
animal passage 4. The identification device 11 may be of
any conventional kind, for instance of a kind identifying
the cows 1 by means of a transponder (not disclosed)
carried by the cows 1. The identification device 11 is
also connected to the control member 10 and arranged to
produce an identification signal to be received by the
control member 10. The control member 10 may comprise a
processor 12, schematically disclosed, for processing the
signals from the sensors 7 and 8 and the identification
signal from the identification device 12 and for producing
output signals to be delivered to further equipment to be
described below. For instance, the control member 10 and
the processor 12 may be arranged to count the cows 1
passing through the animal passage 4 in response to the
signals produced by the sensors 7 and 8. The counted
number of cows 1 may be delivered to a main control and
supervising system provided in for instance a milking barn
housing a large number of cows 1 and including an animal
passage 4 extending between different areas of the barn.

The apparatus may also comprise one or several gate
devices provided in or in the proximity of the animal
passage 4 and arranged to take one of an open position and
a closed position. The gate device in Fig. 1 includes a
so-called interruption gate 14, 15 arranged to close the
passage to prevent cows 1 from moving forward in the
animal passage 4. The interruption gate 14, 15 includes,

in the embodiment disclosed, two gate doors 14, 15, which
are displaceable between said open position and said
closed position by means of a respective associated
activator 16, 17. The interruption gate 14, 15 is
5   connected to the control member 10. The control member 10
and the processor 12 is arranged to control the position
of the interruption gate 14, 15 to one of said open and
closed positions. It is to be noted that the interruption
gate 14, 15 also may be formed by one gate only and one
10   actuator associated with the gate.

Fig. 2 discloses a second embodiment in which the gate
device includes a direction gate 18 displaceable by means
of an associated activator 19. The gate 18 is arranged to
15   take a closed position or an open position. In the closed
position, the animal passage 4 is closed and an exit
passage 20 leading away from the animal passage 4 is open.
In the open position, the animal passage 4 is open for
passage by the cows 1 whereas the exit passage 20 is
20   closed.

In the embodiments disclosed in Figs 1 and 2, there are
merely sensors 7,8 arranged in one plane perpendicular to
the transport direction t. However, according to a third
25   embodiment disclosed in Fig 3, two, three, four or more
sensors may be arranged along one line, or two separate
lines, being parallel to the transport direction t. In the
third embodiment two rows of sensors with four sensors 7,
8 in each row are provided. By means of such plurality of
30   sensors it is also possible to determine a cross-section
size of the animal, not only at one point along the
transport direction but at several points along the
transport direction. In such a way, an image of the
contour of the animal may be created. When such a contour
35   is recognised it may be assumed that an animal is present
at a determined position.

The present invention is not limited to the embodiments disclosed herein but may be varied and modified within the scope of the following claims.